TEST PROJECT — ROBOT SYSTEMS INTEGRATION

工业机器人系统集成测试

Designed by:

FANUC

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1. INTRODUCTION TO TEST PROJECT项目介绍

1.1. COMPETITION CELL竞赛单元（模块）

For each Competition the cell will be modified to present a different set of challenges. The Test Project should be presented to the Competitors in the form of a project specification from an Industrial Customer. In this case it is to process raw widgets through a machining, deburring, assembly and inspection process.

每个竞赛项目都有不同的挑战要调整修改单元（模块？）。测试项目会以工业客户的项目规范（工程说明？）的形式呈现给参赛者。在这种情况下，它是通过加工、去毛刺、装配和检查过程来加工原始部件。

A representative example is shown below.下面是一个具有代表性的例子
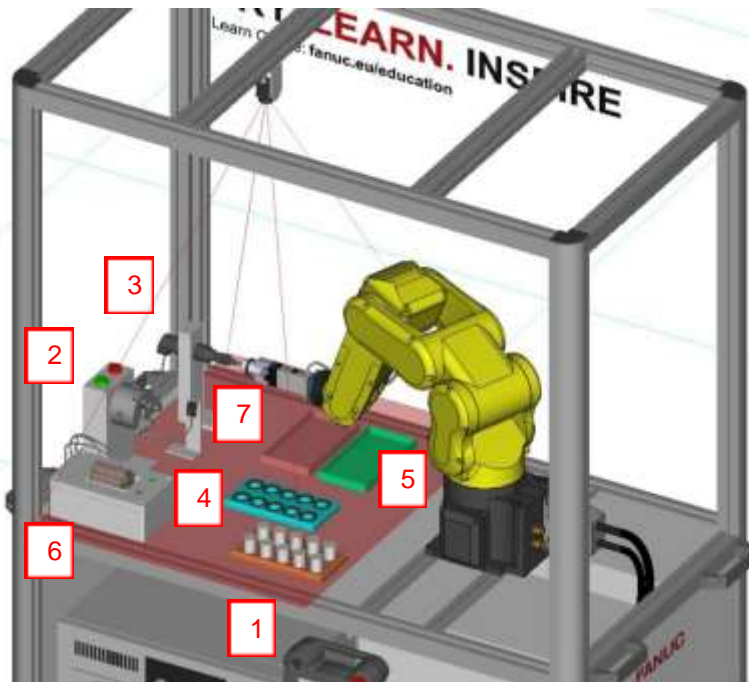
1	Input Tray – with 10 plastic cylinders loaded into it ready for processing. Note that Input Tray has holes to accurately locate cylinders. (See Task Extension) 输入托盘-装有10个塑料钢瓶（汽缸？），准备加工。注意，输入盘有孔，以准确定位气缸。(见任务扩展)
2	Machine Chucks – with LEDs showing status机器卡盘- led显示状态
3	Deburring Tool – low power electrical tool去毛刺工具-低功率电动工具
4	Assembly Tray – loaded with 10 plastic rings which are push-fit onto the cylinder 装配托盘-装上10个塑料环，这些环可以推到气缸上
5	Output Trays – no location holes – simple open trays. Green for good parts, Red for reject parts 输出托盘-没有定位孔-简单的开放托盘。好的零件用绿色，坏的零件（不合格零件？）用红色
6	I/O connection terminal strip – pre-wired into controller but not into sensors/LEDs I/O连接终端条-预连接到控制器，但不连接到传感器/ led
7	Sensor Switch传感器开关

1.2. BASIC CHALLENGE基本挑战

The Basic Challenge will be to set up the cell to run as shown below:
基本的挑战将是设置单元格（模块？）运行如下所示:
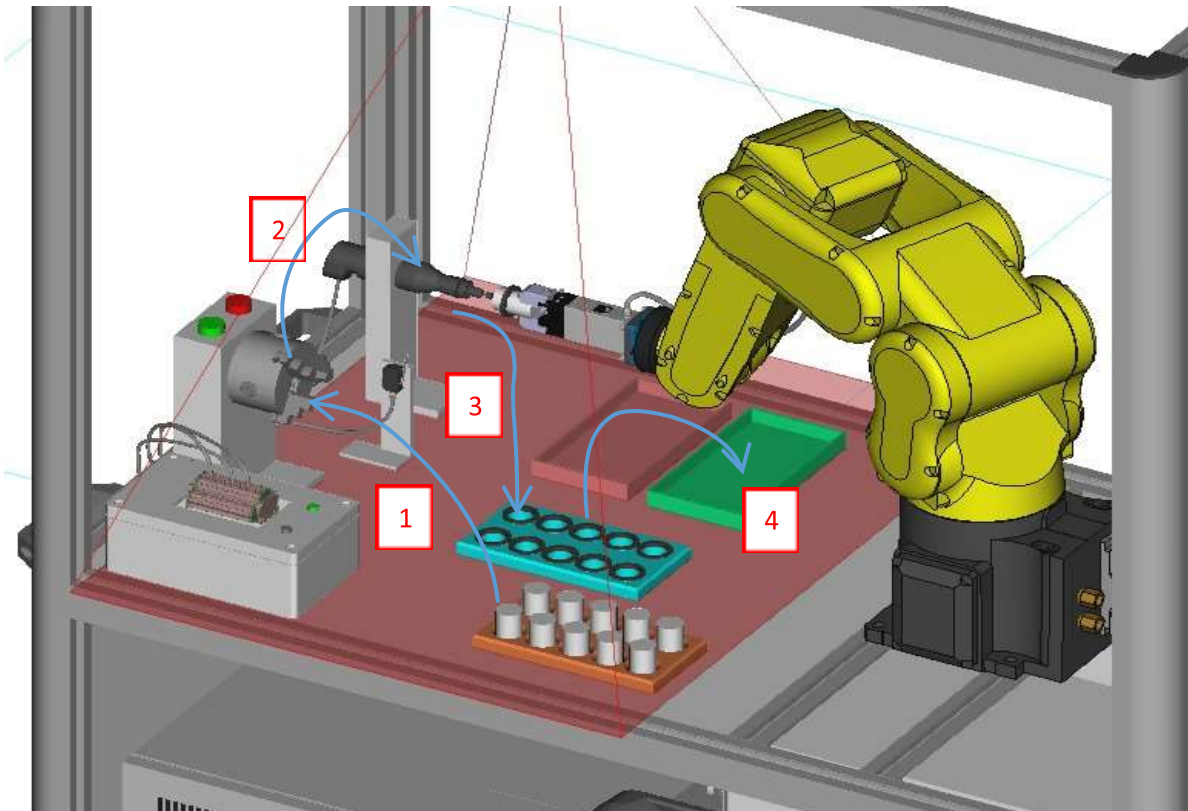
| 1	Pick part from Input Tray and insert into Chuck - Wait for specified machining time
	从输入盘中取出零件，插入卡盘，等待指定的加工时间
2	Transfer part from Chuck to Deburring Tool. Rotate part 360° around tool to simulate deburring – tool should spin up / spin down with suitable timing
	将工件从夹头转移到去毛刺工具上。围绕工具旋转零件360度，模拟去毛刺 -工具应在适当的时间内向上/向下旋转
3	From Deburring tool move part to Assembly Station – press-fit ring onto cylinder
	从去毛刺工具移动零件到装配工位-将压合环压入气缸
4	Assembly Tray – loaded with 10 plastic rings which are push-fit onto the cylinder
	装配托盘-装上10个塑料环，这些环可以推到气缸上
5	sfer to Output Tray转到输出盘

1.3. DETAILS OF ASSEMBLY OPERATION装配操作细节

1) Approach Assembly Tray from Deburring Tool
从去毛刺工具接近装配托盘

2) Move down into Assembly Tray to insert Cylinder into Ring

向下移动到组装托盘中，将钢瓶插入环内
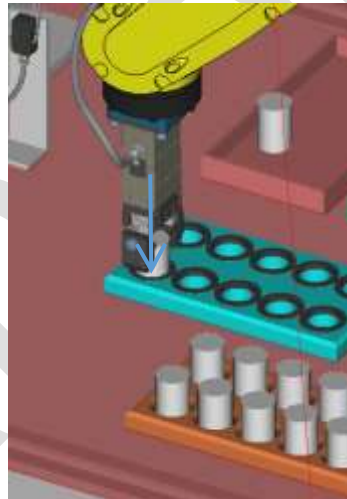
3) Move away from Assembly Tray with combined Cylinder and Ring

从带有组合气缸和密封圈的装配托盘上移开

2. EXTENSION TASK 1 – IRVISION PART LOCATION
扩展任务**1**：集成视觉部分位置（定位？

In order to be able to challenge the competitors to their limits – to be able to differentiate between them, extension tasks are foreseen – additional tasks to be completed after the basic task has been achieved.
为了能够挑战参赛者的极限- -为了能够区分它们，可以预见扩展任务- -在完成基本任务之后还要完成额外的任务。

First Extension Task is to use iRVision for Parts Input第一个扩展任务是使用iRVision作为部件输入
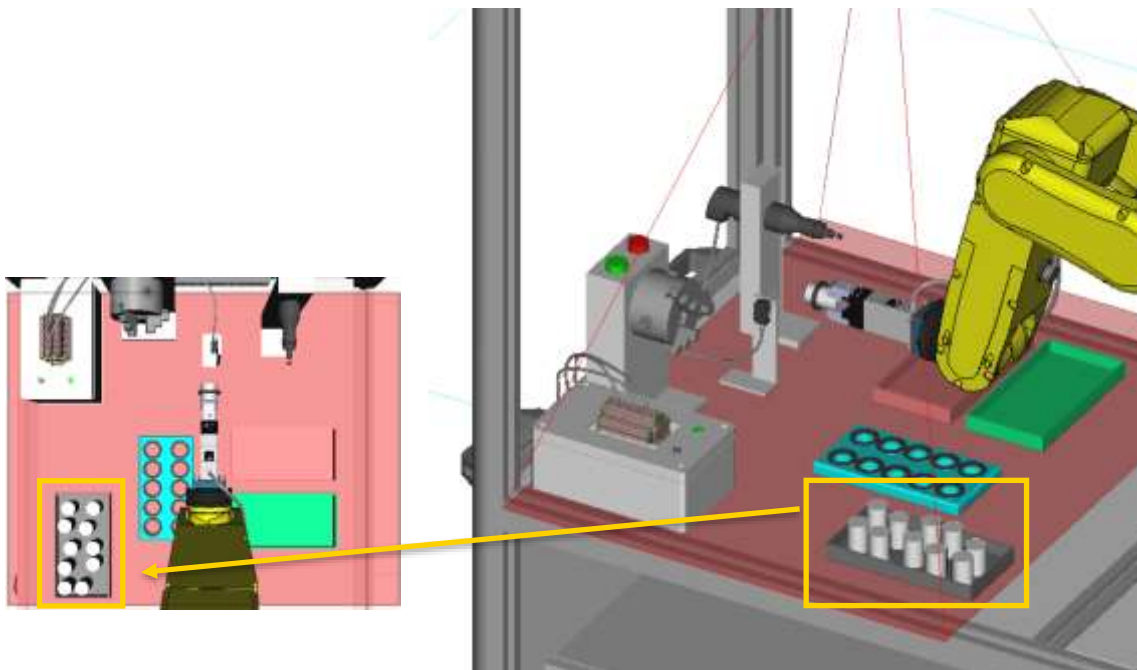
The original Part input tray has fixed locations for the parts.原来的零件输入托盘有零件的固定位置。
This was common practice in industry but is an expensive way to present the parts.
这在工业上是很常见的做法，但这是一种昂贵的展示部件的方式。

The more state-of-the-art method is to use simple parts tray without locations and use Vision to locate the parts before picking.

最先进的方法是使用简单的没有定位的零件托盘，并在拾取（选择？）前使用视觉定位零件。

The FANUC education cell comes with pre-calibrated iRVision 2D camera system installed so competitors can use iRVision to pick the parts from the tray
FANUC教育单元配备了预先校准的iRVision 2D摄像系统，因此竞赛选手可以使用iRVision从托盘中挑选零件。

3. EXTENSION TASK 2 – IRVISION PART INSPECTION

扩展任务**2**：集成视觉部分检查（监测？）

Second Extension Task is to use iRVision for Parts Inspection:

第二个扩展任务是使用iRVision进行零件检查:
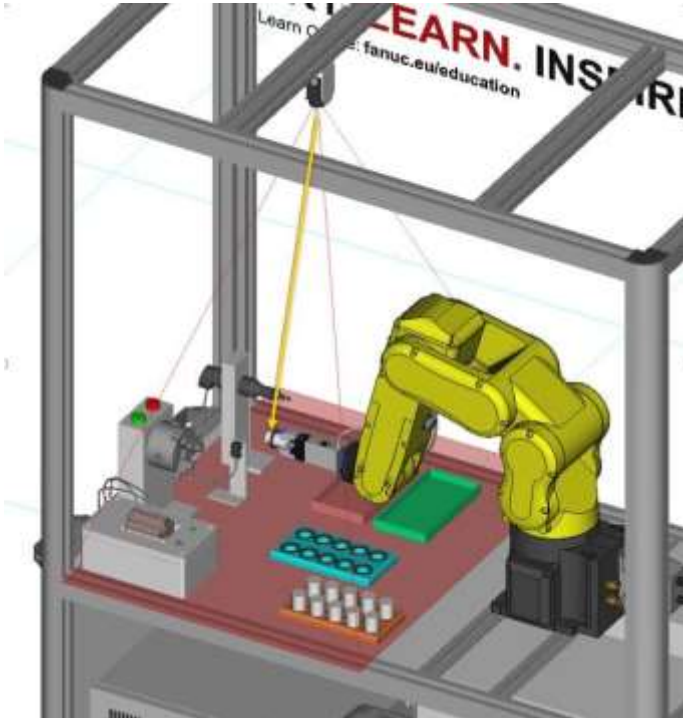
After assembly, the part is presented to the camera as shown above.

Then the camera can check for the presence of the ring – and check OK or NOK.

Depending of the result of the inspection the parts should be placed in the GREEN (OK) or RED (NOK) output

trays.组装完成后，将零件呈现给摄像头，如下图所示。

然后摄像头可以检查环的存在，并检查OK或NOK。

根据检验结果，零件应放置在绿色(OK)或红色(NOK)托盘中。

4. EXTENSION TASK 3 – IHMI USER INTERFACE
扩展任务3：iHMI用户界面

The basic sequence can be executed without any special user interface, but it is common industrial practice to create a custom user interface showing the actual layout of the cell and the progress of parts through the cell, such as shown below:

基本的顺序不需要任何特殊的用户界面就可以执行，但工业上常见的做法是创建一个自定义的用户界面，显示单元格的实际布局和部件在单元格中的进度，如下图所示:
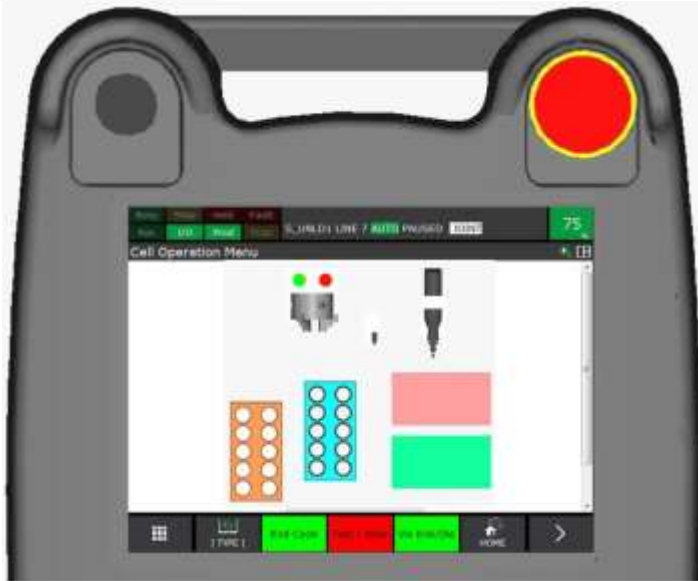
This user interface should be dynamic – updating as the parts are moved through the cell and should have some command buttons as appropriate for the function of the cell.

这个用户界面应该是动态的——当部件在单元格中移动时进行更新，并且应该有一些适合单元格功能的命令按钮。

5. WORLDSKILLS STANDARDS SPECIFICATION ANALYSIS
世界技能标准及规格分析

The table below shows how the Example Competition relates to the WSSS for this skill

下表显示竞赛与世界技能标准及规格之间的关系

WSSS SECTION 世界技能标准及规格		EXAMPLE TEST PROJECT IMPLEMENTATION 测试项目实施范例
01	Work organization and management 工作组织及管理	As a 2-person team, the competitors must work together and separately. The daily planning should give them some guidance on which tasks to execute in parallel, but the competitors must organize themselves efficiently in order to be successful, and to be able to complete the Extension Tasks which will eventually distinguish between competent and excellent performances
02	Communication and interpersonal skills沟通及人际交往技巧	作为一个两个人的团队，参赛者必须懂得合作和分开独立操作。日常计划应该给他们一些指导，哪些任务可以同时并行执行，但参赛选手必须有效地合理安排，以便成功完成比赛。是否能够圆满完成扩展任务的表现将成为界定参赛选手是良好或优秀的关键。
03	Layout and design 布局和设计	Competitors are provided with a PC with FANUC Roboguide simulation system pre-loaded on it. They will also be given CAD files of each component of the Cell- Chucks, Trays, etc. and they should decide layout themselves. They can use the additional features of Roboguide such as cable simulation and modelling to add additional detail / realism to the cell 参赛选手的电脑预装了FANUC Roboguide仿真系统。 他们还将得到每个单元格组件的CAD文件——卡盘、托盘等，他们应该自己决定如何布局。 他们可以使用Roboguide的附加功能，如电缆模拟和建模，以实现附加单元模块额外的细节
04	Installation and connectivity 安装和连接	After deciding layout and completing basic mechanical unit integration, competitors can fix peripheral components directly onto the base panel. They must also decide how to control electrical inputs & outputs, make electrical connections (using push-in terminals – no need for soldering) and do I/O configuration 在确定布局并完成基本的机械单元集成后，参赛选手可以直接将外围组件固定在基板上。 他们还必须决定如何控制电气输入和输出，进行电气连接(使用推入终端-不需要焊接)和I/O配置
05	Automation and programming 自动化和编程	Basic programming task is quite simple, transferring parts from input tray via chuck and deburring tool to assembly station and then to output tray, but to distinguish between competence and excellence there are several extension tasks available: • Use a more sophisticated sequence to feed the machines (chucks) in parallel use to increase productivity. • Use iRVision instead of part locators for more flexible production • Use iRVision or Sensor Switch for Part Checking Create a User interface using HTML and graphics 基本的编程任务很简单，通过卡盘和去毛刺工具将零件从输入托盘转移到装配站，然后再转移到输出托盘，但是为了区分优秀和卓越，有几个扩展任务要完成: 使用更复杂的顺序并行地为机器(chucks)提供数据，以提高生产率。 使用iRVision而不是零件定位器来实现更灵活的生产 使用iRVision或传感器开关进行部件检查，使用HTML和图形创建用户界面

06	Commissioning, maintenance and troubleshooting 调试、维护和故障排除	Maintenance challenges can be set for the robot itself, but also for the application – i.e. removing ring from the assembly tray and checking for appropriate response from the system
		维护挑战赛可以为机器人本身设置，也可以为应用程序设置——即从装配托盘上拆卸环，并检查系统是否有适当的响应
07	Documentation, briefing and reporting 文件、简报和报告	Documentation suitable for handover to the customer should be created.
		For example:
		• User Interface Description (using images from Roboguide and the User I/F to be as realistic / graphic as possible)
		• Program Listing
		• Robot Setup Description (Registers, I/O etc.)
		• List of relevant manuals
		应编写出可以直接给客户看的文档。例如:
		用户界面描述(使用来自Roboguide和用户I/F的图像，尽可能逼真/图形化)
		程序清单
		机器人设置说明(寄存器、I/O等)
		有关的指引、简介及报告一览表

6. DAILY SCHEDULE赛程表

DAY 日期	AM/PM 上/下午	PARALLEL ACTIVITIES (MULTIPLE TEAM MEMBERS) 并行活动(多个团队成员)		DURATION 时长
1	AM 上午	Competitors arrive 选手抵达 All competitor assembly organized by Worldskills 世界技能大赛的所有选手		
	PM 下午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Mechanical assembly of robot + gripper机械手+夹具的机械装配	Design of cell layout using Roboguide使用Roboguide设计单元模块布局	3 hours 3小时
2	AM 上午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Mechanical & electrical installation of peripheral equipment 周边设备机电安装	Off-line programming of sub-programs 子程序的离线编程	3 hours 3小时
	PM 下午 上午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Installation of off-line programs/ programming of basic task 离线程序安装/基本任务编程	Off-line programming of extension task 扩展任务的离线编程	3 hours 3小时
3	AM 上午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Installation of off-line programs/ programming of extension task 离线程序的安装/扩展任务的编程	Off-line programming of User Interface 用户界面离线编程	3 hours 3小时
	PM 下午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Installation of user interface/test run of complete system 安装用户界面/测试运行完整的系统	Start preparation of user Documentation 开始准备用户文档	3 hours 3小时
4	AM 上午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟
		Fine tuning and proving of system. Maintenance testing (Fault Handling) Optional extension task. 系统的微调和证明。维护测试(故障处理)可选扩展任务。	Finalize User Documentation and Simulation 最终确定用户文档和模拟	3 hours 3小时
	PM 下午	Introduction and explanation of task – including safety reminder 任务介绍和解释——包括安全提醒		20 mins 20分钟

		Final demonstration of running system, including extension tasks if accomplished – in form of acceptance test at Customer 运行系统的最终演示，包括完成的扩展任务——以客户验收测试的形式	Presentation of User Documentation and Simulation – in form of handover to Customer 演示用户文档和模拟—以移交给客户的形式	1 hour 1小时
		TOTAL共计		21 hours 21小时